present study explored choice behavior of healthy human participants in a variant of a probabilistic selection task (Frank, 2004). In this task, participants learned through trial and error that abstract representations of novel food packages predicted visual feedback in the form of a humanoid exclaiming either 'yummy', 'okay', or 'yucky', with varying probabilities. As expected, the probability of correct choices increased across trials ($p<0.0001$) and did so more quickly for easy than for difficult stimulus pairs ($p<0.001$). Interestingly, the probability of correct choices given 'yummy/okay' feedback was significantly larger ($p<0.05$) than that for 'okay/yucky' feedback, even after controlling for the other influences. This effect was also evident in the test phase (which examines how learning generalizes across novel combinations of stimuli in the absence of feedback). This result suggests distinct disgust-driven and reward-driven learning mechanisms, engaged here by entirely abstract feedback in a hypothetical 'food choice' learning task. A fuller understanding of the neural basis of these mechanisms will be important if feedback-learning models are to be applied to food choice in humans.

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DISSOCIATING THE NEURAL REPRESENTATION OF RISK CONSTRUCTS IN A NOVEL GAMBLING TASK

Rena Fukunaga[1], Joshua W. Brown; [1]Indiana University — Risk is a concept with multiple meanings that are often disputed when used to inform cognitive neuroscience studies of decision making. This study was designed to test competing hypotheses of how risk is represented in the brain based on different measures of risk. We aimed to dissociate between three types of risk constructs, specifically variance (Preuschoff et al., 2008), loss probability (Brown & Braver, 2005), and the magnitude of a loss (Brown & Braver, 2007). Participants chose between a series of hypothetical gambles that measured their preferences regarding decisions about money. For each given trial, a sure payoff option was presented against a gamble option. Five gamble options were created in order to independently manipulate the risk constructs while keeping the expected value constant across the conditions. Gambles were created to consist of three pairwise comparisons that partially controlled for each of the three risk constructs thus ensuring that any effects from a given pairwise comparison was not due to the controlled factor. Preliminary findings showed a greater bilateral anterior cingulate, right inferior frontal gyrus, and left insula activity at the time of decision with increasing variance of the chosen gamble. In contrast, we found no significant activation for either the loss probability or the magnitude of loss in brain regions known to be involved in representing risk. Our results suggest that the neural representation of risk reflects the variance of the possible outcomes, thus highlighting the importance of distinguishing between the different measures of risk in decision-making paradigms.

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FRAMING EFFECTS IN DECISION-MAKING: ORBITOFRONTAL DAMAGE DISRUPTS THE DECISION, BUT NOT THE FRAMING EFFECT

Anna Garr[1], Lesley Fellows[1]; [1]Montreal Neurological Institute, McGill University — People often make markedly different choices depending on the context in which options are presented, even when the objective values of the options are identical, an irrational choice phenomenon termed the framing effect. For example, people tend to take more risks when the potential for a loss is emphasized, but choose the certain outcome more often when the same decision is framed in terms of potential gains. A recent fMRI study proposed that the framing effect is mediated by the amygdala, with the orbitofrontal cortex (OFC) playing a regulatory role and so promoting more rational choice. Here we asked whether OFC damage alters the framing effect, measured using several widely used tasks including the classic "Asian-Disease Problem", a multi-trial risky decision paradigm with monetary losses and gains, and scenarios where attributes of decision options were framed in positive or negative terms. Thirteen patients with chronic focal damage affecting OFC were compared to 13 patients with frontal damage sparing OFC and 28 demographically-matched healthy participants. OFC damage did not systematically alter the magnitude of the framing effect in any of these tasks although patients with OFC damage were somewhat more likely to make aberrant choices in trials that required right and wrong answers. This argues that the framing effect is the result of simplifying heuristics--decision 'short cuts'--that do not require OFC and highlights the likely existence of multiple decision mechanisms within the human brain.

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NEUROFUNCTIONAL DIFFERENCES RELATED TO THE IOWA GAMBLING TASK IN HEALTHY OLDER ADULTS

Kameko Halfmann[1], Julie Gudenkauf[1], William Hedgcock[1], Antoine Bechara[2], Natalie L. Denburg[1]; [1]University of Iowa, [2]University of Southern California — The Iowa Gambling Task (IGT) is thought to model real-life decisions by factoring in reward, punishment, and uncertainty. Impairment on this task has been associated with circumscribed damage to the ventromedial prefrontal cortex (VMPC). Further, we have demonstrated that two groups of functionally and cognitively intact older adults show divergent behavioral performance (impaired versus unimpaired) on this task – a difference we hypothesize is attributable to disproportionate decline in the prefrontal cortex. To specifically test this hypothesis, sixteen IGT-impaired and sixteen IGT-unimpaired older adults performed an alternate version (K') of the IGT while in a functional magnetic resonance imaging scanner. We predicted that IGT-impaired older adults would have neurofunctional deficits in the prefrontal cortex relative to IGT-unimpaired older adults. In early blocks of the IGT, we observed greater activation among IGT-impaired older adults relative to IGT-unimpaired older adults in ventromedial prefrontal regions. In later blocks of the IGT, we observed greater activation among IGT-unimpaired older adults relative to IGT-impaired older adults in ventral prefrontal regions. These results are consistent with our original hypothesis that there may be disproportionate decline in the IGT-impaired older adults. On a broader scale, these results are consistent with the interpretation of a neural dissociation between decision-making under ambiguity (in the earlier blocks) and decision-making under risk (in the later blocks).

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TEMPORAL DYNAMICS OF NEURAL COMPUTATIONS FOR STIMULUS VALUE AND EFFORT COST

Alison Harris[1], Seung-Lark Lim[2], Antonio Rangel[3]; [1]Claremont McKenna College, [2]University of Missouri-Kansas City, [3]California Institute of Technology — We often make decisions not only based on an item's value, but also the effort required to obtain it: e.g., using a vending machine versus walking to a café. Whereas good-based value is represented in ventromedial prefrontal cortex (vmPFC), recent data has implicated dorsomedial frontal cortex (dmFC) in integrating stimulus value with effort cost to derive net (combined) value. However, the temporal dynamics of net value computation remain unclear. Here we examined this question using event-related potentials (ERP) while hungry subjects decided whether to work at different levels of physical effort cost (low, medium, or high grip strength) for the opportunity to obtain food. Subjects' decisions generally incorporated both stimulus value and effort cost, as indicated by significant logistic fits to their choice curves. Parametric ERP responses associated with net value were visible from 100-300 ms after stimulus onset, negatively correlated with effort cost, and from ~450-650 ms, positively correlated with stimulus value. Distributed reconstruction of stimulus-locked responses revealed significant sources in the vmPFC, but not dmFC. In contrast, response-locked signals were chiefly localized to dmFC and superior parietal sources rather than vmPFC, and largely reflected effort cost computations preceding response. Together, these data suggest that localization of net value integration to vmPFC and dmFC sources depends on whether the data is time-locked to the onset of stimulus or response. In line with a transition from good-based to action-based valuation, computations of effort cost may play an increasing role in dmFC activity in the time directly leading up to choice.

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SEROTONIN TRANSPORTER GENOTYPE MODULATES IMPULSIVE CHOICE IN HUMANS

Catherine Hartley[1], Jonathan Kanen[2], Morgan McKenna[1], B.J. Casey[1], Joseph Kable[3], Elizabeth Phelps[2], Charles Glatt[1]; [1]Weill Cornell Medical College, [2]New York University, [3]University of Pennsylvania — Many important real-world decisions involve weighing actions that yield immediate gratification against those that only pay off over time. The influence of time on the subjective value of a reward varies widely between individuals, yet the origins of such differences are not well understood. A recent theory that serotonin fosters patience during intertemporal choice suggests that genetically mediated differences in serotonergic function may modulate temporal discounting. Here, we test whether a functional serotonin transporter polyadenylation polymorphism (STPP/rs3813034)